value of about 0.1 Torr is set, thereby clearly making it possible to form a polymethyl siloxane film with its very good quality in which the semiconductor device 109 can provide very good operating performance practically.

After the steps up to the step 4 described above had been completed, when the obtained semiconductor device 109 is observed by using an optical microscope (not shown), the oxidization of the surface of the Cu wire 104 is not observed.

In addition, during execution of the steps 1 to 4 and after these steps had been completed, the release of the base insulation film 102, barrier metal 103, Cu wire 104, silicon nitride film 105, and interlayer insulation film 106 (polymethyl siloxane film) is not observed.

In addition, when the resistance of the Cu wire 104 is measured, the measurements were equal before and after forming the polymethyl siloxane film as an interlayer insulation film 106.

As has been described above, according to the present embodiment, the steps 1 to 4 can be completed within a short time, i.e., only seven minutes, by using a heating work and the electron beam irradiation work altogether.

That is, according to the present embodiment, in the insulation film forming steps with only heating

process using a hot plate according to the conventional technique, the film forming with solvent evaporation or precursor bridge reaction can be significantly reduced, which has required 30 minutes to one hour.

In addition, according to the present embodiment, the heating work and the electron beam irradiation work are used in combination, whereby the film burning temperature in the steps 1 to 4 can be restrained to 400℃ as described previously, for example, or alternatively, its upper limit can be restrained to not more than 500℃ even when the temperature is the highest.

That is, according to the present embodiment, in the insulation film forming steps with only the heating process using a hot plate according to a conventional technique, the film burning temperature in the final step of film burning can be reduced, which has required a very high film burning temperature of 500℃ or more.

Therefore, according to the present embodiment, the heating work and the electron beam irradiation work are used in combination, whereby the interlayer insulation film 106 can be formed without having a stimulus to the interlayer insulation film 106 or Cu wire 104 than necessary. In this manner, the grain growth of Cu in the Cu wire 104 in the film forming step is restrained, and the release on an interface between the Cu wire 104 and the silicon nitride film 105 is restrained.

In addition, the vanish is irradiated with the electron beam in an atmosphere of H_2 gas having the reduced pressure reduction properties, whereby the oxidization of the surface of the Cu wire in forming the interlayer insulation film 106 is restrained so that the resistance value of the Cu wire 4 can be maintained at a low level, which indicates a good state. A gas having its reduction properties other than H_2 gas can be used. In general, any gas can be used as long as the oxidization of wires (here, referred to as Cu wire 4) can be prevented, and the quality of film (here, referred to as interlayer insulation film 106) is not degraded.

Therefore, according to the present embodiment, electrical performance (quality) such as inter-wire capacity of the semiconductor device 109 can be improved, and the semiconductor device can be manufactured within a short time. As a result, the yields of the semiconductor 109 is improved, and the productivity of the semiconductor device 109 is improved.

In addition, according to the present embodiment, even if a polymethyl siloxane film that is an insulation film with its low dielectric rate is used as the interlayer insulation film 106, the film can be formed without degrading its performance and can be formed so as to be maintained in a good state within a short